

Micrometeorite Impact Test of Flex Solar Array Coupon

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Spacecraft with solar arrays operate throughout the near earth environment and are increasingly planned for outer planet missions. An often overlooked test condition for solar arrays that is applicable to these missions is micrometeorite impacts and possibly electrostatic discharge (ESD) events resulting from these impacts. The Marshall Space Flight Center (MSFC) is partnering with Space Systems/Loral, LLC (SSL) to examine the results of simulated micrometeorite impacts on the electrical performance of an advanced, lightweight flexible solar array design. The test is performed at NASA MSFC's Microlight Gas Gun Facility. The SSL-provided coupons consist of three strings, each string with two solar cells in series. Five impacts will be induced at various locations on a powered test coupon under different string voltage (0V-150V) and string current (1.1A – 1.65A) conditions. The maximum specified test voltage and current represent margins of 1.5X for both voltage and current. The test parameters are chosen to demonstrate new array design robustness to any ESD event caused by plasma plumes resulting from a simulated micrometeorite impact. A second unpowered coupon will undergo two impacts: one impact on the front side and one impact on the back side. Following the impact testing, the second coupon will be exposed to a thermal cycle test to determine possible damage propagation and further electrical degradation due to thermally-induced stress. The setup, checkout, and results from the impact testing are discussed. The challenges for impact testing include precise coupon alignment to control impact location; pressure management during the impact process; and measurement of the true transient electrical response during impact on the powered coupon. Results from pre- and post-test visual and electrical functional testing are also discussed.

Key words: flex solar array, micrometeorite impact testing, ESD testing